

Historic, archived document

Do not assume content reflects current scientific knowledge, policies, or practices.

932
1948

UNITED STATES DEPARTMENT OF AGRICULTURE
Agricultural Research Administration
Bureau of Agricultural and Industrial Chemistry
Northern Regional Research Laboratory
Peoria 5, Illinois

FACTS ABOUT THE INDUSTRIAL UTILIZATION OF STRAW

The Situation --

Recent technical advances, resulting from research on the utilization of straw, make possible a large expansion of the market for this farm commodity. For instance, straw has been found suitable for blending with wood pulp to make fine papers, and it can also be used in the manufacture of various insulating building-board products. These are potential new uses for straw. But at the present time, farmers who grow wheat and rye are failing to supply the strawboard and paper market which already exists. Mills which manufacture corrugating strawboard and related products are faced with a chronic straw shortage, while on the farms near them a large percentage of the straw produced is wasted. The problem is chiefly one of collecting the straw and delivering it to the mills at a cost which is both profitable to the farmer and economical for the manufacturer.

Today's Straw Market --

The largest industrial use for straw at present is in making corrugating strawboard. This is the fluted material often seen as a liner in cartons and boxes. It is made in 26 mills of the Middle West (see Table I) which produce annually about 500,000 tons of strawboard from 800,000 tons of straw. This strawboard is used for egg-crate separators and fillers, for the pads that protect fruit and other produce shipped in boxes and barrels, and for similar products. Some straw is also used for coarse grades of wrapping paper.

Tomorrow's Markets --

A large potential market for straw is offered by the Paper industry. Research by the U. S. Department of Agriculture's Northern Regional Research Laboratory at Peoria, Ill., indicates that straw pulp can be substituted for 25 to 40 percent of the wood pulp now used in making fine and specialty papers. In fact, this is already being done commercially in Holland, where the process used is one developed by the Northern Regional Laboratory.

Straw is not new to the paper industry. During the past hundred years, in Europe, South Africa, South America, and the Orient, very fine papers have been produced from straw. England was forced to use straw during the war and is still employing it in the manufacture of many types of paper. A mill in Argentina now produces about 100 tons daily of fine paper from straw. But in the United States, 98 percent of the pulp used for paper comes from wood. Since the supply of pulpwood is dwindling -- we are using it faster than it is being grown -- the opportunities for straw in the paper industry are considerable. Straw can be harvested every year, and it will continue to be available as long as wheat is grown.

Another possibility is the use of straw for making insulating board. For many years, sugarcane bagasse -- the crushed, juiceless sugarcane as it comes from the mill -- has been a preferred material for the manufacture of high-grade insulating products. However, the Northern Regional Laboratory has recently demonstrated that wheat straw is the equal of bagasse for this purpose, and a process for commercial manufacture, using standard machinery, has been developed.

The Shortage of Straw --

The strawboard industry was established in this country around 1900, when wheat was harvested with binders and threshed, and every wheat farm had its straw stack. The straw could be baled from these stacks by stationary balers as a year-round operation. When the combine harvester came into general use, most of the straw stacks disappeared, and it was some time before pick-up balers were developed to make straw collection on the farm a practical operation. As a result, the strawboard mills began to experience a shortage of the raw material they required. Mills in Ohio, Indiana, and Illinois, for example, frequently had to go as far away as Colorado, the Dakotas, Arkansas, or even Louisiana to secure adequate supplies. Transportation costs, naturally, were high.

Now that one-man balers have been developed, and steel is becoming available for their manufacture, the mills have better possibilities of obtaining their straw from nearby farms. They are anxious to build up close and friendly relations with local farmers within easy hauling distance, and thus insure a reliable supply of straw. This will keep shipping costs at a minimum and enable the mills to pay better prices to farmers.

Straw Collection As a Farming Practice --

Farmers who bale and transport their own straw to the mills will realize the best profit from straw sales, and in general the strawboard industry is encouraging this practice. With the present high price for wheat, the cash return which the farmer can obtain from straw may seem small; but in terms of net profit, particularly in normal times, it may add 8 to 20 percent to his cash income from wheat.

Of course, if the straw can be used on the farm, it should not be sold to industry. Each farmer must determine for himself whether he can sell his straw profitably. In this connection, the agricultural aspects of straw collection should be considered. Prof. C. J. Willard, Agronomist of Ohio State University, has found after 10 years of experimenting that combine straw and stubble left on land planted to leguminous cover crops, clover, or alfalfa, decreased the yield of these soil-building and forage crops from 30 to 60 percent. His work shows also that the effect of straw on yields carries over into the following year. Professor Willard's findings are generally applicable throughout the soft winter wheat area. He recommends that the stubble be cut very low, and that all of the straw be removed from the land as soon after combining as possible. This straw may well be baled for use on the farm or for sale to industry.

The Potential Straw Supply --

Annual cellulose requirements of the United States for making paper, board, and dissolving pulps for chemical uses are now estimated at approximately 21 million tons. The annual production of insulating building materials from cellulose represents about another 1 million tons. To manufacture these products requires approximately 48 million tons of fibrous plant material, and at the present time 98 percent of this demand is supplied by wood.

In 1945, 78 million tons of wheat straw was produced. A high proportion of the wheat crop in the chief wheat-growing states was combine harvested, and about 40 million tons of the straw was estimated as recoverable. Approximately 9 percent of this recoverable straw was used or sold as baled straw, 19 percent was used or sold as loose straw, and 72 percent was left in the fields or otherwise not utilized. (See Table II.)

In 1947, 95 million tons of wheat straw was produced. If we apply the distribution ratios of 1945 to this crop, it becomes evident that about 38 million tons of straw was probably wasted last year -- enough to supply more than two-thirds of our total cellulose requirements. Also, if better harvesting methods were used a larger percentage of the straw would be recoverable.

The wheat-growing areas in which the strawboard mills are located produce more than enough excess straw to supply not only the present demands of these mills, but a greatly expanded paper industry as well. The information in Table II, based on 1945 statistics supplied by the Bureau of Agricultural Economics, shows that most of these states have a surplus of more than 800,000 tons, the requirements of the present strawboard industry.

What Is Being Done --

Two meetings between representatives of strawboard mills, farm equipment manufacturers, and several state agricultural experiment stations were held at the Northern Regional Laboratory last year. As a result, a practical specification for baled straw suitable for use by the strawboard and paper industry was agreed upon. Satisfactory bales can be made by many of the one-man balers now manufactured, if the machines are properly operated. A number of equipment manufacturers are making certain changes in their one-man balers, so that they will produce satisfactory bales even under adverse conditions. It was agreed at the conference that the farm equipment manufacturers would arrange through their dealers to supply more complete instructions to enable farmers using their balers to produce bales of proper weight. The strawboard mills are planning a campaign to promote straw collection. Supplementing these efforts, the Department of Agriculture is undertaking a broad educational program during May this year, in cooperation with radio stations, farm journals, and state Extension Services, to provide information to farmers.

Standards for Baled Straw --

Manufacturers of strawboard and straw papers require clean, dry, sound wheat or rye straw, cut as close to the ground as practicable. The straw should not include green weeds, because this leads to rotting in the bales and difficulties in

processing. Combined straw collected soon after harvest will come closest to meeting these conditions. The density of the bales should not be less than 9.3 pounds per cubic foot of air-dry straw; for a standard bale of 16 x 18 x 42 inches, the minimum weight is 65 pounds. This is the lightest bale which will withstand the transportation, storage, and mill handling involved in industrial processing. The bales must be tied with 14-gauge wire, preferably galvanized. Twine ties have proved wholly unsatisfactory. The straw should not contain more than 5 percent chaff, and it should not be baled if wet, since wet straw will rot in the bale. The strawboard mills will accept straw during the entire year, but they will not pay full price for wet, dirty, or rotten straw. Efficient and careful operation of the present combines and balers will enable farmers to turn out satisfactory straw bales.

Future Prospects --

The market for straw as a raw material for making paper, while relatively small at present, is expected to expand in the near future. Manufacture of paper and board now ranks fifth among our industries in the United States. Pulp wood, the mainstay of this industry, is scarce and becoming increasingly expensive. Insulating building-board products are now widely used, and this industry is also growing. Straw is an ideal material for both of these industries. As long as wheat is grown, straw will be produced on farms. Whether or not the potential industrial market for this straw is developed depends in large part upon the initiative of farmers. But the prospects are that straw will become an increasingly important industrial commodity, and that farmers who take advantage of better collection methods will realize, more and more, a substantial profit from the sale of their straw.

TABLE I

Names and Addresses
of
STRAWBOARD MILLS in the UNITED STATES

Alton Box Board Company Alton, Illinois	Muskingum Fiber Products Corp. Coshocton, Ohio
Ball Brothers Company Noblesville, Indiana	River Raisin Paper Company Monroe, Michigan
Central Fibre Products Company Quincy, Illinois Mt. Carmel, Illinois Vincennes, Indiana Toma, Iowa Hutchinson, Kansas Denver, Colorado	American Box Board Company Grand Rapids, Michigan Waldorf Paper Products Company St. Paul, Minnesota Simplex Paper Corporation Adrian, Michigan
Consolidated Paper Company Monroe, Michigan	Queen City Paper Company Tipp City, Ohio
Container Corporation of America Circleville, Ohio Carthage, Indiana	Otsego Falls Paper Mills, Inc. Otsego, Michigan
Stone Container Corporation Coshocton, Ohio	The Terre Haute Paper Company Terre Haute, Indiana (2)
Dresden Paper Mills Company Dresden, Ohio	The Hinde and Dauch Paper Company Sandusky, Ohio (2) Ft. Madison, Iowa
Fort Wayne Corrugated Paper Company Vincennes, Indiana	

TABLE II

Estimated Production and Utilization of Wheat Straw
in Strawboard Manufacturing States, 1945⁽¹⁰⁾

	: Produced ^{a/}	: Recoverable ^{b/}	: Used on farm	: Unused or
	: : 1000 tons	: : 1000 tons	: : 1000 tons % ^{c/}	: : 1000 tons % ^{c/}
	: : 1000 tons	: : 1000 tons	: : 1000 tons % ^{c/}	: : 1000 tons % ^{c/}
Ohio	: 4,024	: 2,414	: 1,545 64	: 869 36
Indiana	: 2,449	: 1,469	: 823 56	: 646 44
Illinois	: 1,737	: 1,042	: 417 40	: 625 60
Michigan	: 1,890	: 1,134	: 771 68	: 363 32
Minnesota	: 1,487	: 892	: 526 59	: 366 41
Iowa	: 186	: 112	: 69 62	: 43 38
Total	: 11,773	: 7,063	: 4,151 59	: 2,912 41
U. S.	: 77,576	: 46,546	: 13,033 28	: 33,513 72

^{a/} 70 tons per 1000 bushels of wheat.

^{b/} 60 percent of straw produced when combined as standing grain.

^{c/} Based on recoverable straw.

Figure in parenthesis refers to Literature Cited.

